THURSDAY, JULY 21, 1892.

DR. MIVART'S ESSAYS.

Essays and Criticisms. By St. George Mivart, F.R.S. (London: Osgood, M'Ilvaine, and Co., 1892.)

DR. MIVART has collected in two portly volumes a number of essays and critical reviews which he has from time to time contributed to current monthly or quarterly literature. The ground covered is tolerably extensive; from "Jacobinism" and "The French Revolution" to "Weismann's Theories" and "Eimer on Growth and Inheritance;" from "Austrian Monasteries" and "The Greyfriars" to "Herbert Spencer" and "Hermann Lotze." We have read the whole, or almost the whole, with interest, and not without admiration of the author's wide knowledge, his earnest purpose, and his power of clear exposition. Here, however, we are chiefly concerned with those essays which deal with scientific problems. They are well worthy of reperusal in their present collected form, and that chiefly because Dr. Mivart holds definite and in some respects peculiar views on evolution, because he has the advantage of some training in philosophy, because he is a learned and acute critic, and because he has pre-eminently the courage of his convictions.

It is scarcely necessary to remind the readers of NATURE that Dr. Mivart is one of those who hold that natural selection has played a quite subordinate part in the evolution of organisms. He believes that the concurrence of certain external exciting causes acts in such a manner on internal predisposing tendencies as to determine by direct modification the evolution of new specific forms. Furthermore he affirms that, beyond the domains of merely physical science (which, though much, is not everything), reason demands a non-mechanical conception—namely, the conception of an immanent active principle or soul in everything which lives. And he contends that between the self-conscious reason of man and the mere sensuous feeling of the higher brutes, there is a great and impassable gulf fixed. These are among the more important positions which the author of these "Essays and Criticisms" assumes in the field of biological speculation. And to these may, perhaps, be added his condemnation of the doctrine of the relativity of knowledge, and his belief in common-sense realism, apparently on the assumption that the external reality of the objective world (as opposed to its *phenomenal* existence) is directly apprehended by the intellect, though it cannot be reached through sensuous feeling.

On all these matters Dr. Mivart has much that is interesting to say, and says it in an interesting manner. It would manifestly be impossible here to discuss so wide a range of problems. We therefore propose to select one matter—that of the relation of human reason to brute intelligence—on which to offer a few remarks.

In the essay entitled "A Limit to Evolution," the author seeks to establish the impossibility of mental evolution as applied to man. He insists, and rightly insists, that the great difference between man and the lower animals lies not in his bodily but in his mental constitution; and he contends, again in our opinion with perfect justice, that in order to examine this question we must begin by looking a little carefully into our own minds, and by examining our own acts and mental nature. As the result of this examination he finds that our psychical operations fall into two classes; on the one hand, there are feeling (sensitivity), imagination and sensuous memory, sensuous emotion, sense-perception, and sensuous inference; on the other hand, there are intellectual perception, ideation and conception, abstract ideas, and moral and æsthetic concepts. "The contrast, the difference of *kind*," he says, "which exists between this *intellectual conception* and the various forms of *feeling* is very great." We thus possess a dual psychical nature, on the one side sensuous, on the other side intellectual. The sense-perceptions of the one and the abstract ideas of the other "belong to utterly different categories, and a nature which has this power of abstraction is separated from any nature which has *not* that power, by a gulf which is an impassable *limit to evolution*, because feeling and intellect are both thus different in nature, and progress and develop along different and more or less diverging roads." But the psychical powers of brutes are limited to sense-perception, and give no evidence of the possession of the higher faculty of ideation and conception. Therefore the passage from the so-called mind of the brute to the conceptual mind of man is not only impossible but inconceivable.

Such in brief is Dr. Mivart's line of argument. Now, we hold that the distinction between the higher self-conscious, reflective, and conceptual powers of man, and his lower sensuous, non-reflective, and perceptual mental activities is a valid and valuable one, and one which is too often lost sight of. And we hold, further, that our author is right, in the main if not entirely, in denying to brutes the higher powers of conceptual thought. Again, we agree with Dr. Mivart in regarding the progress and development of sense-perception and abstract thought as more or less divergent. Where we part company with him is in the assumption, for such it appears to us, that these divergent lines of development cannot have a common origin. In all that he has written on the subject we fail to find any adequate justification for this dogmatic assertion so often and so confidently reiterated. The distinction between mere sense-perception and reflective thought is frequently drawn with admirable lucidity and clearness; but the impossibility of their having a common psychical root is merely asserted with a few rhetorical flourishes. We venture to question the assertion. Dr. Mivart is not, be it noted, content to assume the modest but perfectly legitimate scientific position that no one has yet succeeded in showing the early stages of the divergence, the tentative beginnings of the reflective process, the gradual focussing of the mental eye upon the processes of consciousness. He does not take his stand on a "not proven," but on a somewhat dogmatic "impossible"—not merely an "impossible" to this or that or the other factor in evolution from the nature of the factor, but broadly and generally an Impossible that is as worthy of a big initial letter as the Unknowable itself!

We cannot take leave of Dr. Mivart's volumes without again calling attention to the fact that they are full of matter interesting to the student of evolution. His scientific conclusions are not altogether those to which

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we have ourselves been led, though there are not a few matters on which we have the pleasure of agreeing with him; his psychological and philosophical views are not in all respects those which we have reached, though here again we are on many not unimportant questions on his side; but we believe him to be an honest and fearless inquirer after that Truth which stands on the title-page of a work to which, perhaps, for some of our readers, these volumes of essays may form a suitable introduction. C. Ll. M.

PHYSICAL OPTICS.

A Treatise on Physical Optics. By A. B. Basset, M.A., F.R.S. (Cambridge: Deighton, Bell, and Co., 1892.)

A NEW treatise on the higher branches of physical optics must be welcome to all who are interested in the subject. Mr. Basset explains in the preface the scope and aim of his book, and it is needless to say that he performs the task he has set himself with ability and success. If, nevertheless, we close the book with a feeling of disappointment, it is because we could have wished that the author had been more ambitious, and attempted to give us a little more than a compilation of the standard papers on the subject. There is one sentence in the preface which, though it evidently does not express what the author meant to say, yet may serve as a peg whereon to hang the only criticism which can fairly be raised against Mr. Basset's treatment of his subject. "I have a profound distrust," says the author, "of vague and obscure arguments based upon general reasoning instead of upon rigorous mathematical analysis." Now, if we are to have vague and obscure arguments, it does not seem to matter much whether they are founded upon general reasoning or upon mathematical analysis, however rigorous that may be. In a subject which is in a state of growth, it may be possible to hide, but it is impossible to avoid, all obscurity and vagueness; and original work ever consists in the attempt to overcome such obscurities. By purposely excluding everything that is vague from a physical treatise, we destroy all possibility of making the work useful in stimulating further research. There are two ways of dealing with difficulties: we may try to overcome them, or we may run away from them. Mr. Basset chooses the latter course, and though some of us might have wished him to be a little more venturesome, we gratefully accept what he has given us, and the above remarks only apply to certain parts of the book. After an introductory chapter, Mr. Basset treats of the interference of light. He follows the time-honoured custom of taking Fresnel's mirrors and the biprism as the simplest case of interference. The effects which are observed are seriously modified, however, by so-called diffraction effects, and we might perhaps have expected a book of this kind to have entered a little more fully into the subject. That the author avoids all reference to experimental details is a distinct advantage, and renders his book more lucid and valuable for reference. It is much to be wished the author's plan could be more generally followed, and that all lengthy discussions of instrumental details could be kept out of theoretical treatises, and relegated to separate books.

The diffraction of light is fully discussed in chapters iv., v., and xiii. Mr. Basset has followed safe guides in the treatment of his subject, and it is perhaps this part of the book which will be specially valuable to the teacher and student.

It is well that the phenomena of double refraction should be first approached without more allusion to the difficult subject of the constitution of the ether than is absolutely necessary, and this is perhaps most easily done by following, as Mr. Basset does, the historical method, and starting from Fresnel's deductions.

The colours of crystalline plates are, of course, treated in an important chapter, and it is worthy of note that Mr. Basset does not introduce the somewhat misleading distinction between the effects produced by parallel and by convergent or divergent beams. In the usual polariscopes a number of parallel beams pass through the crystalline plate in different directions. If the optical arrangement between the plate and the eye is such that these various beams enter the eye, we get the phenomena which are often called interference effects in divergent light, while if those beams only which make a small angle with each other are allowed to pass the pupil, we get the uniform tint described as the effect of parallel light. Both kinds of effects might also be produced if instead of parallel beams we had a number of pencils diverging from points in a plane close to the crystalline plate. In either case the eye is supposed to focus for an infinite distance, and the different appearance is only one of degree, depending on the extent of the angle between the different rays passing through the crystal and into the eye.

Mr. Basset enters fully into the consequences of the various hypotheses which have been made as regards the differences of density or elasticity of the ether in different media. The investigations referred to by him are, of course, of the utmost importance, but it should have been pointed out that as regards application to optics they are wanting in reality. We know enough now to be able to say that the medium does not behave like an elastic body, and in some form or other the electro-magnetic theory must be considered as established. It seems idle, therefore, to discuss whether the hypothesis of Green or of Neumann is most contradicted by experiment. It would have been perhaps worth while to bring out more clearly the fact that *no* elastic theory of the ether has yet been found satisfactory, and that if the electro-magnetic theory had not come to help us we should be in a very serious difficulty.

It is true, of course, that we are at present unable, and probably always shall remain unable, to discard the elastic theories, because the study of transverse vibrations can only be satisfactorily carried out with the help of examples in which we understand to some extent the mechanism by which the vibrations are propagated. But unless a writer chooses to follow a purely historical treatment, it would seem to be more satisfactory to separate completely the mathematical study of vibrations from the subject of optics. Treated purely as elastic vibrations we may usefully discuss what would happen at the boundary between two media having different elasticities or densities;

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